EDITORIAL ARTICLES.

HOFFA ON THE PATHOLOGICAL ANATOMY OF SCOLIOSIS.[1]

THE German Surgical Congress was fortunate in being addressed upon this interesting and important subject by the well-known author of the "Lehrbuch der orthopädischen Chirurgie."

The scoliotic spine does not have its convexity directed to the side, he says, but laterally and posteriorly, so that the most pronounced wedge-formation is in the most posterior segment of the lateral curvature.

The asymmetry of the scoliotic trunk arises from the fact that the concave side is lower than the other, being also larger and broader.

In cases of pronounced scoliosis the difference between the two sides of the bodies of the vertebræ is very marked. The original border of the bodies can be identified as a denser segment of bone sunken into the nucleus pulposus. A large portion of bone is found situated on the concave side between this border and the root of the vertebral arch, which has in profile the form of an olecranon. The apex of this piece is to be found where the inclination of the vertebræ begins. Its base is directed backward and somewhat downward. The borders of the two basilar surfaces of the body project prominently towards the concave side and posteriorly, while they are supported by strong pillars of compact substance in the depths of the bone.

When the scoliotic vertebra is viewed from above, it is observed that the oblique portion of the concave side is greatly widened towards the vertebral arch, so that a large part of the arch on the concave side seems to be drawn in towards body. The posterior border of the thus widened body is thereby rendered thin and sharp on the concave side, while the anterior border of the vertebral foramen loses in roundness.

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[1] Zur pathologischen Anatomie der Skoliose (mit Demonstrationen), Verhandlungen der deutschen Gesellschaft für Chirurgie, XXII Kongress, 1894.

Though little known but of great importance is the condition of the ascending articular processes. It is characteristic that the spinous processes on the concave side are considerably lower than those on the other side. This depression is often so pronounced that the superior part of the joint is reduced to a thin, transparent leaf of bone. With the articular process, of course, the entire condition of the articular surfaces become changed; in fact, these latter changes are discernible before any change can be discovered elsewhere in the process. The first thing of a pathological nature which appears upon the articular surface is a broadening of the concave surface and a narrowing of the convex surface. The enlargement of the concave surface of the joint proceeds by the gradually-increasing atrophy of the concave joint surface so that the descending articular process of the upper vertebra forms a new joint surface upon the lower part of the lower vertebra, in such a way that the upper surface of the transverse process is involved in the new arthrosis.

At the angle of the vertebral wedge the following condition is eventually found: The superior articular surfaces of the concave side are widened considerably in a lateral direction, so that they often involve the entire width of the articular processes. At the same time they become situated lower, reduced in size, and their direction becomes changed. They become directed obliquely from behind and internally forward and outward, so that the outer sides are directed more anteriorly than the inner, because they are no longer placed transversely, but with their superior free border directed forward.

The form of the nearthrosis is very characteristic. When the vertebra is in a position of strong rotation the joint surface is seen to be widened more towards the concavity of the curvature, so that the end of the joint projects somewhat over the anterior part of the arch. When the rotation of the vertebra is less, this lateral projection of the joint is not observed, but a deep lateral groove is present.

In pronounced cases the ascending articular processes of the lowest vertebra of the curvature are seen to form a wall which is formed in a half-circle and placed from behind and internally forward and outward, and flattened towards the median line. The corresponding descending processes of the upper vertebra are so formed as to fit into this ridge, and all motion to the side or forward or backward is rendered impossible.

Hoffa gives the above description as an addition to the knowledge of the pathological anatomy of scoliosis, and regards it as the key to the explanation of the origin of the disease.

Another cause for the lateral curvature of the spine is the predisposition due to an abnormal softness of the skeleton, which eventually produces the wedge-shaped deformity of the vertebral bodies just as the same condition results in a curving of the bones in rachitis.

As these bones gradually become hardened by the deposit of new calcareous cells, it will be found that the largest deposit of bone-cells takes place on the concave side or where the pressure and compression is greatest.

On the convex side where the pressure is least an absorption or rarefaction of the bone takes place. A series of sections through the body of the bone shows a gradual transformation of the dense to the spongy condition as the sections are made from the concavity towards the convexity.

The architecture of the scoliotic spine depends entirely upon the statical conditions. This is seen in the angle where the bony layers are arranged obliquely,—that is, in an angle to the two basal surfaces of the bone. This obliquity of the position of the intra-osseous columns shows the direction of the force which is acting upon the bone.

The direction of these bony columns in such a compressed portion of bone is directly the reverse of that of the fibres of the cortex of the same bone. The direction of the latter depends upon the longitudinal ligaments, but the former depends upon the pressure due to torsion and curvature.

When no torsion of the intra-osseous columns is found in the bodies of scoliotic vertebra, what explanation can be offered for the so-called torsion of the scoliotic spine? Nicoladoni has claimed that the torsion of the scoliotic spinal column is only an apparent condition and not real, and that the deception is caused by the general optic impression of the pronounced asymmetry of the bodies. Hoffa is inclined to agree with Nicoladoni, though he does not entirely deny the existence of torsion. The torsion is not at the articulations between the vertebræ, but is due to changes by which the individual vertebræ are changed in their relation to one another by being rotated upon a diagonal axis.

Purely lateral movements are possible only in the lumbar region. Every lateral bending of the dorsal and especially of the cervical portions of the spinal column is combined with rotation of the spine about a diagonal axis, when the spine is bent slightly to one side, first the intervertebral disks are compressed on the concave side, while at the same time the articular surfaces upon the concave side come together. If, now, the binding is carried still further, a hypomochlion is formed, over which the vertebra at the farthest convexity of the curvature is carried. This vertebra makes a rotation around a diagonal axis, and, of course, swings its neighbors with it. The pressure from a bone does not impinge directly upon the lateral surfaces of the vertebra at the vertex of the curvature, but upon the lateral and posterior aspect; and thus the greatest obliquity is found at this part. This is the first sign of torsion. A later sign which can be seen on the body of the vertebra is the drawing in of the anterior end of the root of the arch into the superior surface of the body. This causes the declination of the spinal column, or what is the same thing, the loss of the physiological antero-posterior curvature. To this change belongs the broadening of the postero-lateral aspect of the inferior surface of the body towards the concavity of the curvature, which is associated with a sliding forward of this part upon the next body below. Further signs of torsion must be sought for in the articular processes, induced by the sliding forward of one vertebra upon its lower neighbor. Here the changes are not difficult to discover. Hoffa has observed the forward dislocation of the superior articular surface and the posterior dislocation of the inferior surface on the concave side, as well as the change of direction of the joint cavity, which becomes more obliquely situated so that the upper articular surface of the joint becomes drawn from within outward and more forward.

There are still a large number of the phenomena of torsion which are easily explained. They depend simply upon the pressure upon the diagonally dislocated vertebræ.

The rotation of the upper surface of the body upon the lower surface is a result of such pressure. This rotation is found especially in the anterior portion of the body, and results from the traction of the anterior longitudinal ligament upon the bodies of the vertebræ.

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